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(54) Method and system for inputting gestures

(57) The present invention relates to a system, method and medium for receiving and acting upon user input. In one embodiment, the user may only have access to a limited input device, like a stylus. Using the present invention, a user is provided with intuitive responses from the system based on inputs from the limited input device.

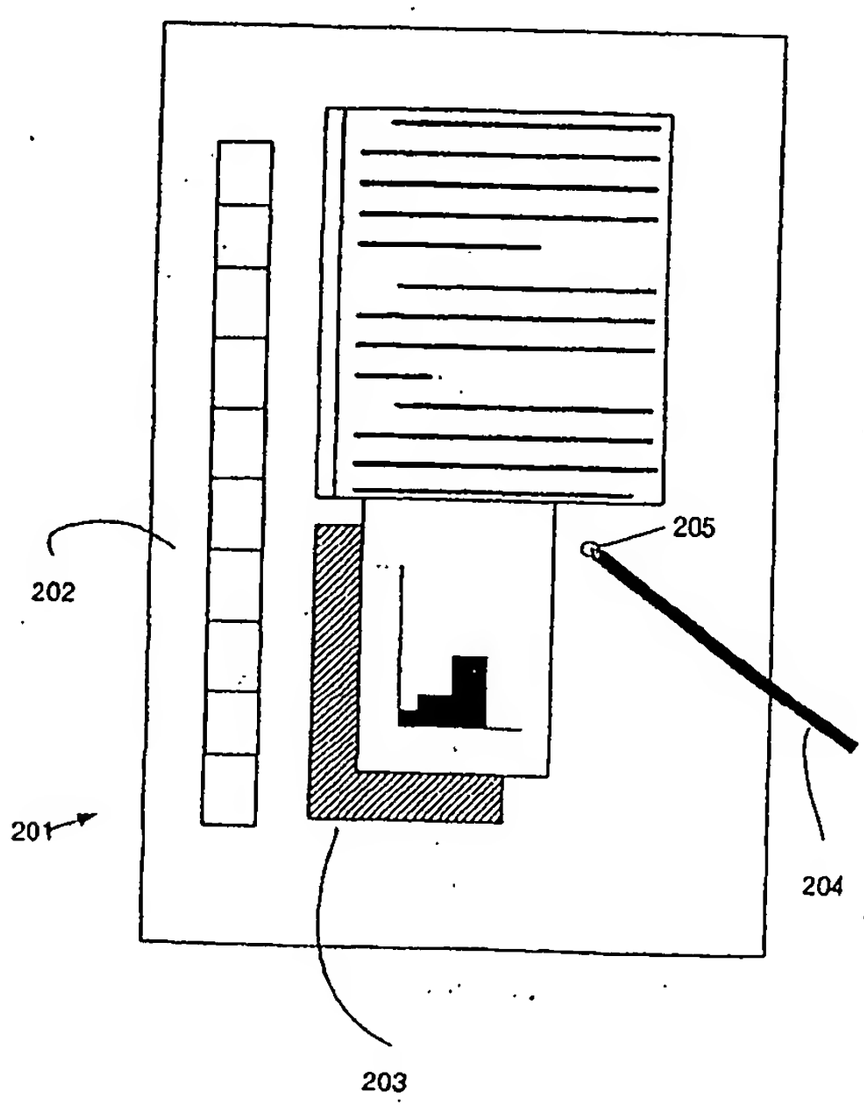

Figure 2

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action.

[0009] A number of inputs with a stylus are possible. For example, a user may tap a stylus, stroke the stylus, hold the stylus at a given point, or hold then drag the stylus. Other inputs and combinations are possible as noted by the above-identified applications, which are expressly incorporated herein by reference.

[0010] As to a stroke operation, the system may drag an object, may maintain a current state or operation, or being inking. Inking may include writing, drawing, or adding annotations as described in greater detail in U. S. Serial No. 60/212,825, filed June 21, 2000, entitled "Methods for Classifying, Anchoring, and Transforming Ink Annotations" and incorporated by reference.

[0011] As to a tap operation, the system may add to existing writing, may select a new object, insert a cursor or insertion point, or may perform an action on a selected object.

[0012] As to a hold operation, the system may simulate a right mouse button click or other definable event.

[0013] As to a hold and drag operation, the system may drag a selected object or perform other functions.

[0014] These and other features of the invention will be apparent upon consideration of the following detailed description of preferred embodiments. Although the invention has been defined using the appended claims, these claims are exemplary in that the invention is intended to include the elements and steps described herein in any combination or subcombination. Accordingly, there are any number of alternative combinations for defining the invention, which incorporate one or more elements from the specification, including the description, claims, and drawings, in various combinations or subcombinations. It will be apparent to those skilled in the relevant technology, in light of the present specification, that alternate combinations of aspects of the invention, either alone or in combination with one or more elements or steps defined herein, may be utilized as modifications or alterations of the invention or as part of the invention. It is intended that the written description of the invention contained herein covers all such modifications and alterations.

Brief Description of the Drawings

[0015] The foregoing summary of the invention, as well as the following detailed description of preferred embodiments, is better understood when read in conjunction with the accompanying drawings, which are included by way of example, and not by way of limitation with regard to the claimed invention. In the accompanying drawings, elements are labeled with three-digit reference numbers, wherein the first digit of a reference number indicates the drawing number in which the element is first illustrated. The same reference number in different drawings refers to the same element.

[0016] Figure 1 is a schematic diagram of a general-purpose digital computing environment that can be used to implement various aspects of the invention.

[0017] Figure 2 is a plan view of a tablet computer and stylus that can be used in accordance with various aspects of the present invention.

[0018] Figures 3-7 are flowcharts showing a variety of steps for interpreting a user's input in accordance with embodiments of the present invention.

Detailed Description of Preferred Embodiments

[0019] The present invention may be more readily described with reference to Figures 1-7. Figure 1 illustrates a schematic diagram of a conventional general-purpose digital computing environment that can be used to implement various aspects of the present invention. In Figure 1, a computer 100 includes a processing unit 110, a system memory 120, and a system bus 130 that couples various system components including the system memory to the processing unit 110. The system bus 130 may be any of several types of bus structures including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. The system memory 120 includes read only memory (ROM) 140 and random access memory (RAM) 150.

[0020] A basic input/output system 160 (BIOS), containing the basic routines that help to transfer information between elements within the computer 100, such as during start-up, is stored in the ROM 140. The computer 100 also includes a hard disk drive 170 for reading from and writing to a hard disk (not shown), a magnetic disk drive 180 for reading from or writing to a removable magnetic disk 190, and an optical disk drive 191 for reading from or writing to a removable optical disk 192 such as a CD ROM or other optical media. The hard disk drive 170, magnetic disk drive 180, and optical disk drive 191 are connected to the system bus 130 by a hard disk drive interface 192, a magnetic disk drive interface 193, and an optical disk drive interface 194, respectively. The drives and their associated computer-readable media provide nonvolatile storage of computer readable instructions, data structures, program modules and other data for the personal computer 100. It will be appreciated by those skilled in the art that other types of computer readable media that can store data that is accessible by a computer, such as magnetic cassettes, flash memory cards, digital video disks, Bernoulli cartridges, random access memories (RAMs), read only memories (ROMs), and the like, may also be used in the example operating environment.

[0021] A number of program modules can be stored on the hard disk drive 170, magnetic disk 190, optical disk 192, ROM 140 or RAM 150, including an operating system 195, one or more application programs 196, other program modules 197, and program data 198. A user can enter commands and information into the computer 100 through input devices such as a keyboard 101 and pointing device 102. Other input devices (not shown) may include a microphone, joystick, game pad, satellite

ceived signal as a user's input. Other methods of starting an operation or writing or contact with a digitizer are known in the art. For purposes of illustration and description, the system and method reference physical contact with the digitizer. All other ways of providing signals to a processor are considered within the scope of the invention and are not mentioned here for simplicity.

[0030] In step 302, the system determines the contact position and what lies beneath the contact position (for example, an object, a drawing, blank space, ink, and the like). In step 303, the system determines if the stylus has moved beyond a first threshold (time, distance, rate, or acceleration, and the like): In one embodiment, the threshold is set to the minimum resolvable movement. In another embodiment, the threshold is set higher to account for shaky hands, vibrations of the digitizer or tablet pc (for example, if trying to use the system while driving in a car over a bumpy road). It is noted that objects may have all the same threshold. Alternatively, objects may have different thresholds. This may be dependent on the object, the size of the object, the state of the system, the state of the object, and the like.

[0031] If the first threshold has been exceeded, then the system proceeds to step 304 where the user's input is classified as a stroke and the system steps to point A 305. If the first threshold has not been exceeded, the system determines if the stylus was still in contact with the digitizer when a time threshold had expired in step 306. If no (meaning that the stylus was still in contact with the digitizer surface), the system classifies the input as a tap in step 307 and proceeds to point B 308.

[0032] If the stylus was still in contact with the surface after the time threshold in step 306, the system determines if a second move threshold was exceeded in step 309. The first and second move thresholds may be identical or different: For example, both may be .25 mm. Or, the first may be .5 mm or one mm and the second be 3 mm. Further, the first may be 1.2 mm or more and the second may be .5mm or more. In short, any values may be used as long as they are not obtrusive to the user. The second threshold may be determined only after the time threshold of step 306 has expired. In this example, the second threshold may be higher than the first threshold (or it may be the same or smaller).

[0033] If the second move threshold was not exceeded, then the system classifies the input as a hold in step 310 and proceeds to point C 311. If the second move threshold was exceeded, then the system classifies the input as a 'hold and drag' in step 312 and moves to point D 313.

[0034] Figure 4 shows point A as starting point 401. Here, the system classified the input as a stroke and begins stroke processing in step 402. In step 403, the system determines if the stroke started on a draggable object. If yes, the system determines in step 404 whether drag threshold was exceeded (for example, .25 inches, .25 inches per second and the like). If so, the system classifies the stroke as a drag in step 405 and performs a function that is dependent on the object. For example, the drag may extend a selection as described in greater detail in "Selection Handles in Editing Electronic Documents," filed concurrently with the present application (attorney docket 03797.00069), and expressly incorporated by reference. Also, the drag may operate a bungee tool as described in Serial No. (Atty docket 3797.00070), entitled "Insertion Point Bungee Space Tool", and filed concurrently with the present application, and expressly incorporated herein.

[0035] If, in step 404, the drag threshold has not been exceeded, the system maintains the current state (with the object being selected or not) in step 407. If the stroke was not over a draggable object in step 403, the system determines if the area under the contact point is inkable in step 408. For example, inkable may mean an area capable of receiving ink (including drawings, annotations, or writing) as detailed in serial no. 60/212,825, filed June 21, 2000, and expressly incorporated herein by reference for essential subject matter. By contrast, a control button (for copy, save, open, etc.) may not be inkable. If inkable in step 408, the system permits inking (drawing, writing, annotating and other related functions) in step 409. If not inkable, the system maintains the current state (objects selected or not) in step 407.

[0036] In Figure 5A, the system starts at point B 501 and operates on the input as a tap 502. The system determines whether the tap was on an area or object that is inkable in step 503. If yes, the system determines whether any ink was recently added or "wet" (for example, less than .5 or 1 second old) in step 504. If so, the system considers the tap as a dot to be added to the ink in step 505 (and adds the dot). If no wet ink exists, then the system determines if the tap was over a selectable object in step 506. It is noted that steps 503 and 504 may be combined. If the tap was over a selectable object, then the system determines if the object was already selected in step 507. If it was not, then the system selects the tapped object in step 508. If a previous object had been selected, the system cancels the previous or old selection in step 509. If the object was previously selected as determined by step 507, the system performs an action relevant to the object in step 510. This action may include editing the object, performing a predefined operation (for example, enlarge, shrink and the like). From step 506, if the tap was not on a selectable object, then the system proceeds to point BB 512.

[0037] Figure 5B shows additional processing to Figure 5A. As point BB 512, the system determines if the tap was in a space between text (referred to herein as an inline space) in step 513. If yes, the system places an insertion point at the tap point in step 514. As shown in a broken lined box, the system may also cancel any old or previous selections in step 515. If no, then the system determines if the tap point has ink nearby in step 518. If the system determines that the tap was nearby ink, then the system adds a dot to the ink in step 516. If there was an old selection, then the system cancels the

time threshold and said input does not satisfy said second move threshold, said input is classified as a hold.

8. The method of classifying a user's input according to claim 2, wherein, if said input does not satisfy said time threshold and said input satisfies said second move threshold, said input is classified as a hold and drag.

9. A method of classifying a user's input to a computer comprising the steps of:

receiving a user's input;
classifying the user's input as one of a stroke, a tap, a hold, or a hold and drag based on at least one of the input satisfying a move threshold and a time threshold.

10. A method of implementing a stroke input to a computer comprising the steps of:

determining whether said stroke input started on a draggable object;
determining whether said stroke input satisfies a drag threshold;
in response to said first determining step and said second determining step, dragging said draggable object.

11. A method of implementing a stroke input to a computer comprising the steps of:

determining that said stroke input did not start on a draggable object;
determining that location of said stroke input is inkable; and,
adding ink to said location.

12. The method according to claim 11, wherein said adding ink step includes at least one of drawing, writing, or annotating.

13. A method of implementing a tap input to a computer comprising the steps of:

determining at least one of whether a location of said tap includes wet ink, whether said location is in an inline space, whether said location includes a selectable object, and whether said object was previously selected; and
performing at least one of adding a dot of ink, selecting said selectable object, placing an insertion point in said inline space, or performing an action associated with said object.

14. The method of classifying a user's input according to claim 7, further comprising the step of:

simulating a right mouse click.

15. The method of classifying a user's input according to claim 8, further comprising the step of:

dragging a selected object.

16. A computer-readable medium storing a program for operating a digitizer, said program comprising the steps of:

receiving user input;
classifying the user input by using at least one of a time threshold and a movement threshold; and,
performing an action based on the user input.

17. A computer-readable medium storing a program for classifying a user's input to a computer, said program comprising the steps of:

receiving a user's input;
classifying the user's input as one of a stroke, a tap, a hold, or a hold and drag based on at least one of the input satisfying a first move threshold, a time threshold, and a second move threshold.

18. The computer-readable medium according to claim 17, wherein said classifying step is based on at least two of the input satisfying said first move threshold, said time threshold, and said second move threshold.

19. The computer-readable medium according to claim 17, wherein said classifying step is based on the input satisfying said first move threshold, said time threshold, and said second move threshold.

20. The computer-readable medium according to claim 17, wherein, if said input satisfies said first move threshold, the input is classified as a stroke.

21. The computer-readable medium according to claim 17, wherein, if said input does not satisfy said first move threshold and said input does not satisfy said time threshold, the input is classified as a tap.

22. The computer-readable medium according to claim 17, wherein, if said input does not satisfy said time threshold and said input does not satisfy said second move threshold, said input is classified as a hold.

23. The computer-readable medium according to claim 17, wherein, if said input does not satisfy said time threshold and said input satisfies said second move threshold, said input is classified as a hold and drag.

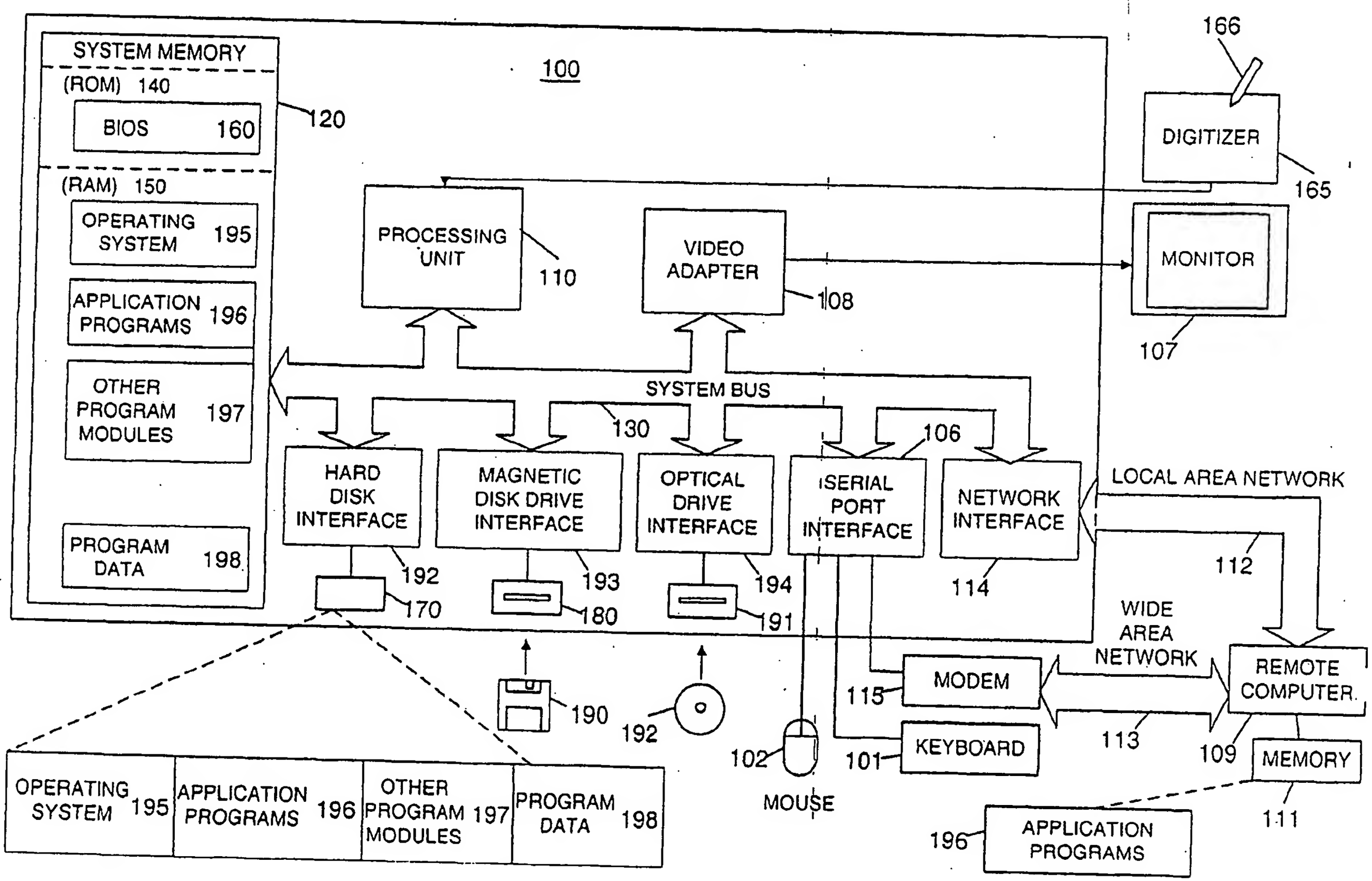

Figure 1

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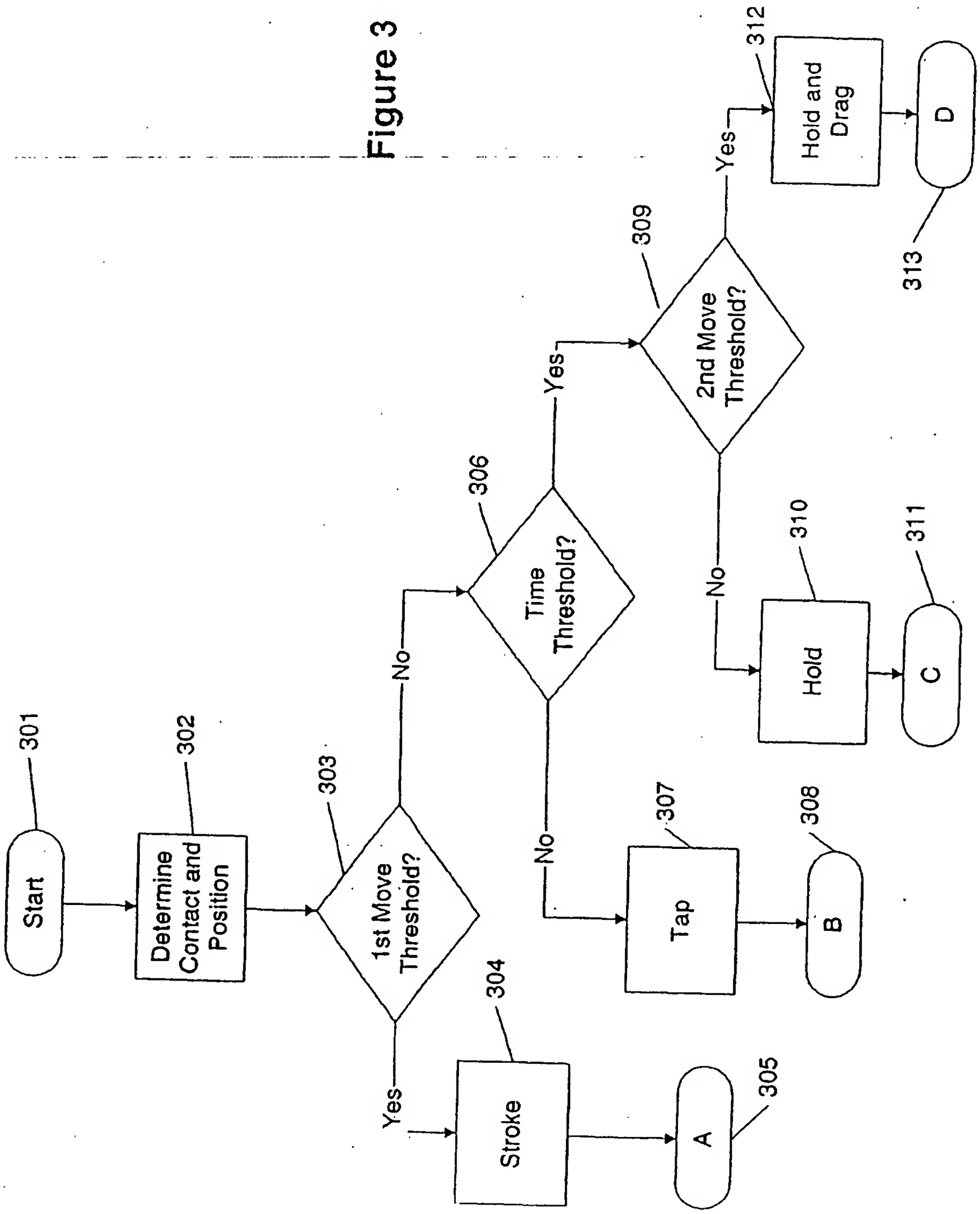
Figure 3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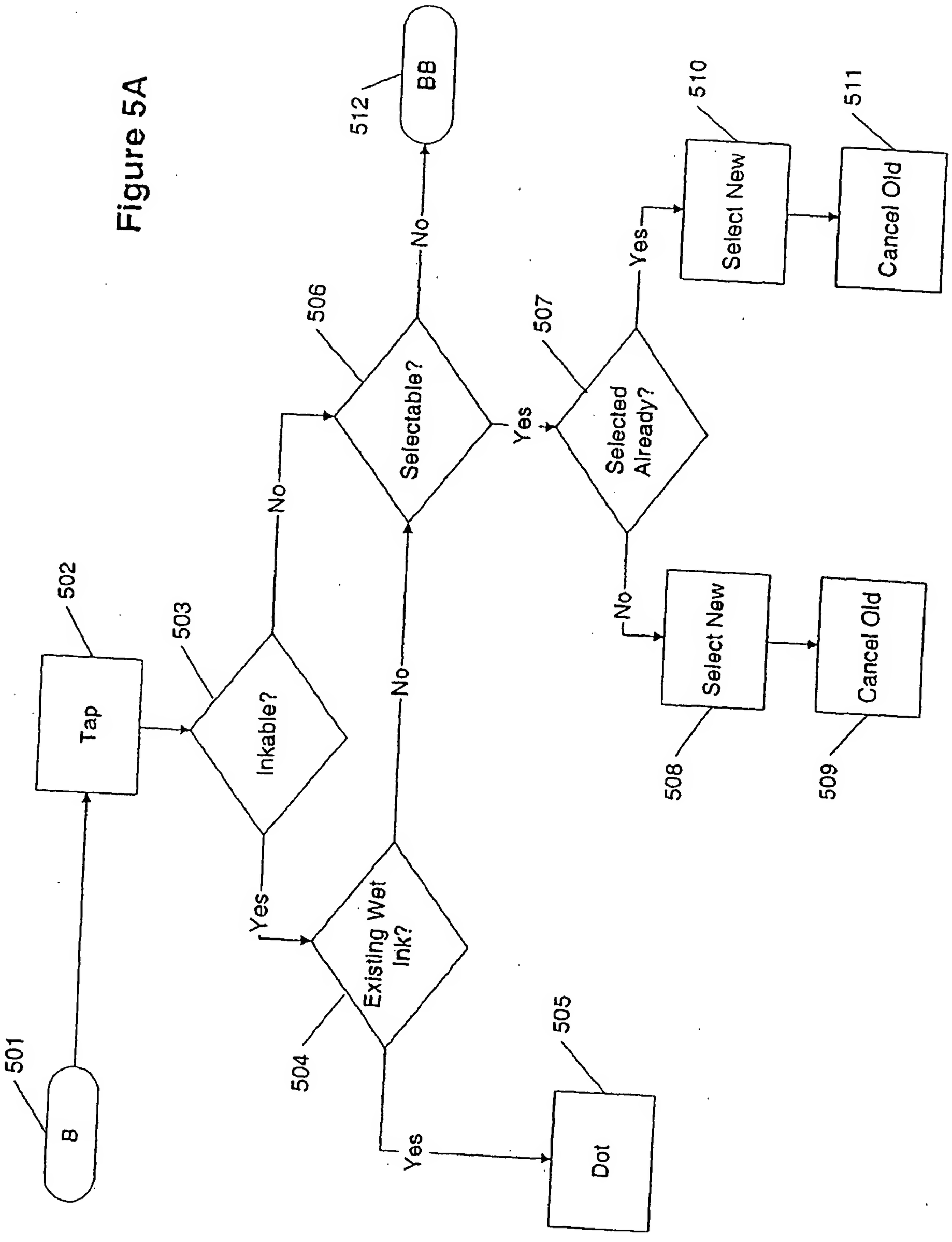
302
1st Move Threshold?
303
Stroke
304
A
305
Tap
307
B
308
Time Threshold?
306
2nd Move Threshold?
309
Hold
310
C
311
Hold and Drag
312
D
313
No
Yes
No
Yes
No
Yes

Figure 5A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Tap
503
Inkable?
504
Existing Wet Ink?
505
Dot
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Selectable?
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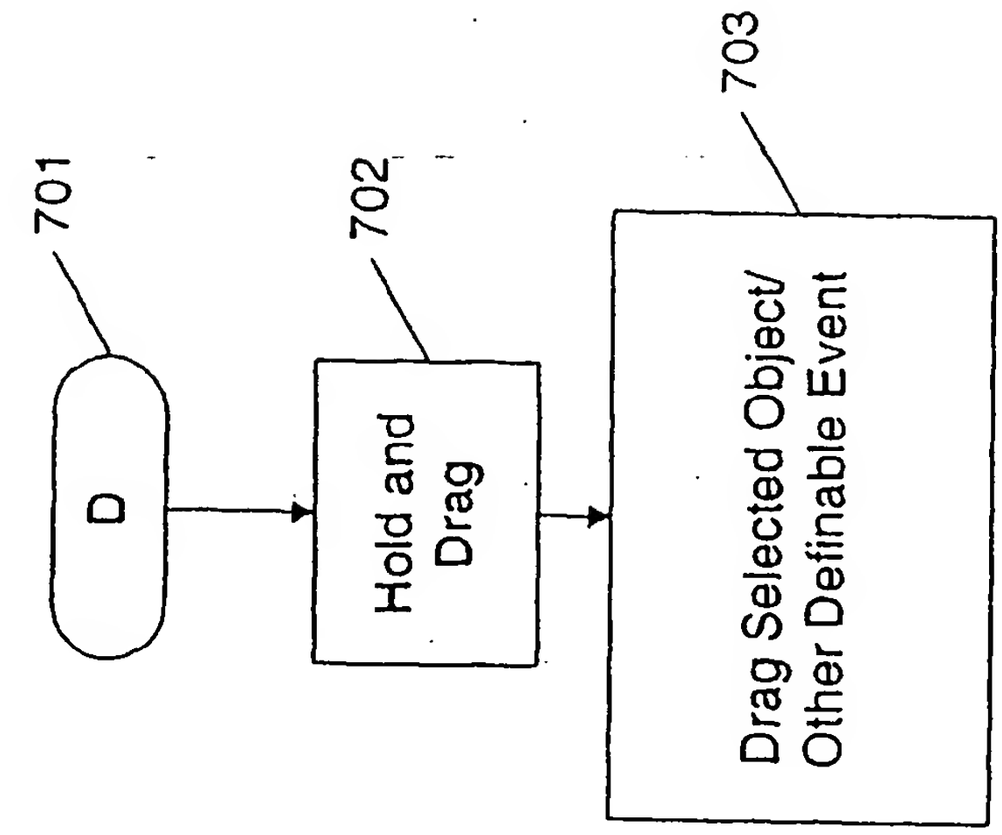

Figure 7

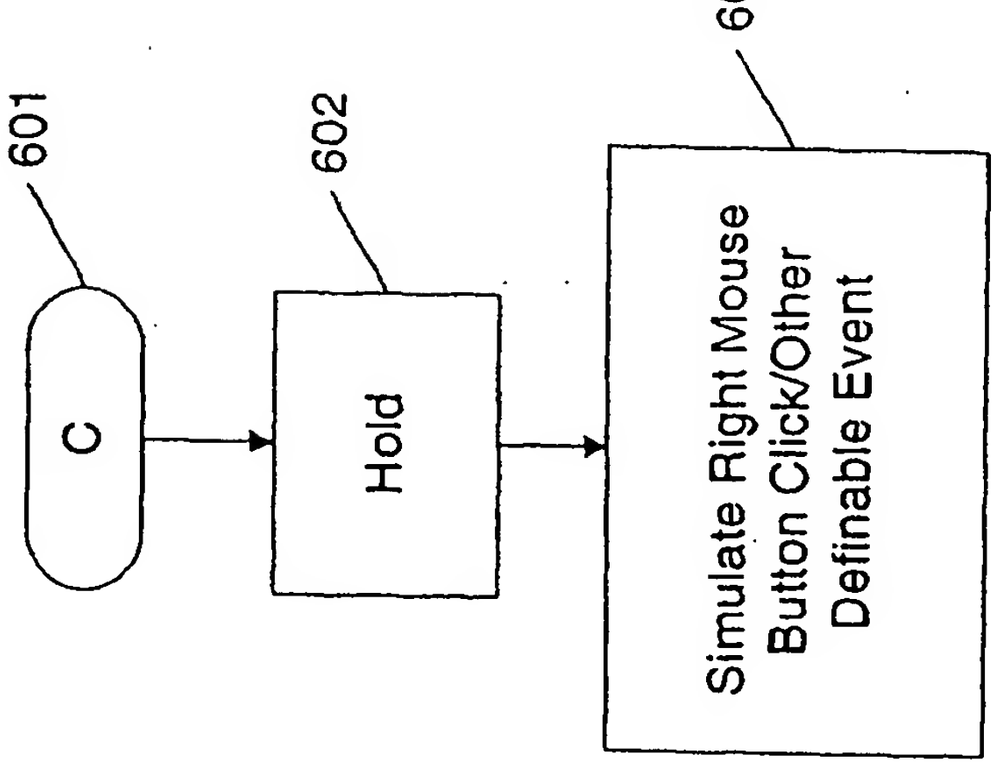

Figure 6